

CLAIMS:

- AA ^{SUB} 1. A method of microwave assisted chemical analysis comprising,
- providing a sample within a vessel,
- heating said sample by microwave energy to volatilize at least a portion of said sample to establish a gas phase,
- cooling said gas phase while continuing to heat said sample by said microwave energy, and
- analyzing the unvolatilized portion of said sample to determine the composition of said unvolatilized portion.
2. The method of claim 1 including
- (employing a said sample) containing silicon, and
- said unvolatilized portion including trace elements contained in said silicon containing sample.
3. The method of claim 2 including
- determining the identity and quantity of at least some of said trace elements.
- AE ^{SUB} 4. The method of claim 1 including
- performing said process in a closed said vessel.
5. The method of claim 1 including
- withdrawing at least a portion of said gas phase from said vessel.
- A3 ^{SUB} 6. The method of claim 1 including
- employing as said vessel a vessel which has portions which are transparent to microwave energy.

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- A4 Sub

AS SUB

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15. ~~The method claim 14 including~~

said process being a continuous process.

16. The method of claim 1 including
employing a liquid as said sample.

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17. ~~The method of claim 1 including~~
~~during said process introducing additional said sample into~~
said vessel.

18. The method of claim 17 including
during said process withdrawing at least a portion of said
gas phase from said vessel.

19. The method of claim 2 including
effecting substantially complete retention in said
unvolatilized portion of all of said trace elements.

20. A method of microwave assisted chemical purification
comprising
providing a sample within a vessel,
heating said sample by microwave energy to volatilize at
least a portion of said sample to establish a gas phase,
cooling said gas phase while continuing to heat said sample
by said microwave energy, and
purifying at least a portion of said gas phase to establish a
purified portion of said sample.

21. The method of claim 20 including

employing a said sample containing silicon

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converting said sample into said gas phase and unvolatilized portions, and

said unvolatilized portions being trace elements originally contained in said silicon containing sample.

22. The method of claim 21 including performing said process in a closed said vessel.
23. The method of claim 21 including withdrawing at least a portion of said gas phase from said vessel.
24. The method of claim 21 including employing as said vessel a vessel which has portions which are transparent to microwave energy.
25. The method of claim 21 including employing polycrystalline silicon as said sample.
26. The method of claim 21 including employing a vessel with at least two compartments in communication with each other, introducing a silicon containing sample and a first acid into a first said compartment, and introducing a second acid into a second said compartment.
27. The method of claim 26 including employing nitric acid as said first acid, and employing hydrofluoric acid as said second acid.
28. The method of claim 27 including

distilling said hydrofluoric acid into said first compartment,
and

distilling SiF_4 into said second compartment.

29. The method of claim 20 including
employing as said microwave energy energy of a frequency
of about 27 to 2450 megahertz.

30. The method of claim 29 including
employing a said vessel composed of a fluoropolymer.

31. The method of claim 20 including
said vessel having a unitary chamber.

32. The method of claim 1 including
during said process introducing additional sample into said
vessel.

33. The method of claim 20 including
employing a liquid as said sample.

34. The method of claim 20 including
during said process withdrawing at least a portion of said
gas phase from said vessel.

35. The method of claim 21 including
employing a said sample containing silicon, and
said unvolatilized elements being trace elements contained

a vessel transparent to microwaves for receiving a sample containing at least one other material,

said vessel having a space above the region wherein said sample will be present for receiving a gas phase,

cooling means for positively cooling said gas phase to reduce the temperature of said gas phase without effecting substantial cooling of said liquid phase, and

means for obtaining access to the portion of said sample which has not been converted into said gas phase.

37. The apparatus of claim 36 including means for withdrawing at least a portion of said gas phase from said vessel.

38. The apparatus of claim 37 including means for introducing additional said sample into said vessel.

39. The apparatus of claim 36 including said vessel being structured to receive said sample in a lower portion thereof, and

said cooling means being disposed in an upper portion of said vessel.

40. The apparatus of claim 36 including said vessel having at least two compartments in communication with each other.

41. The apparatus of claim 36 including means for introducing into said vessel at least one material selected from the group consisting of air, nitrogen and carbon dioxide.

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